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This guide is designed for use by any person or groups of persons responsible for planning occupational programs in the machine trades. Its major purpose is to elicit the necessary information for the writing of educational specifications for facilities to house needed vocational programs in machine tool operation, machine shop, and tool and die making. The material is also designed to (1) assist planners in the formation of creative solutions to the housing of desired educational programs, (2) prevent important considerations from being overlooked in the facility planning process, and (3) encourage logical and systematic facility planning. The guide is organized into four major parts: (1) Introduction, a discussion of the major purpose, (2) The Instructional Program, in which important information is sought on the machine shop department basis program features, objectives, and the kinds of occupational programs which will be organized to implement them, (3) Distinct Types of Instructional Areas to be Provided, in which the actual spaces desired to house the vocational programs are described in detail, and (4) Annotated Bibliography, a list of detailed reference sources. (HC)

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RESEARCH 24

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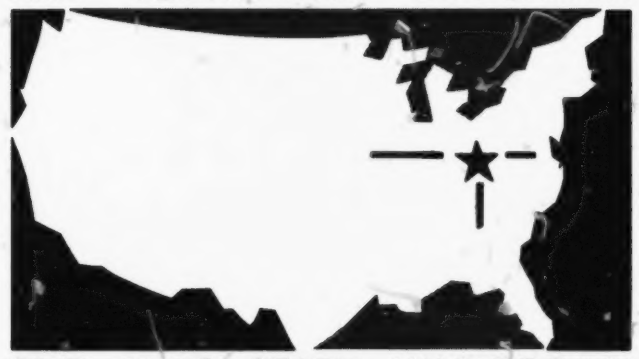

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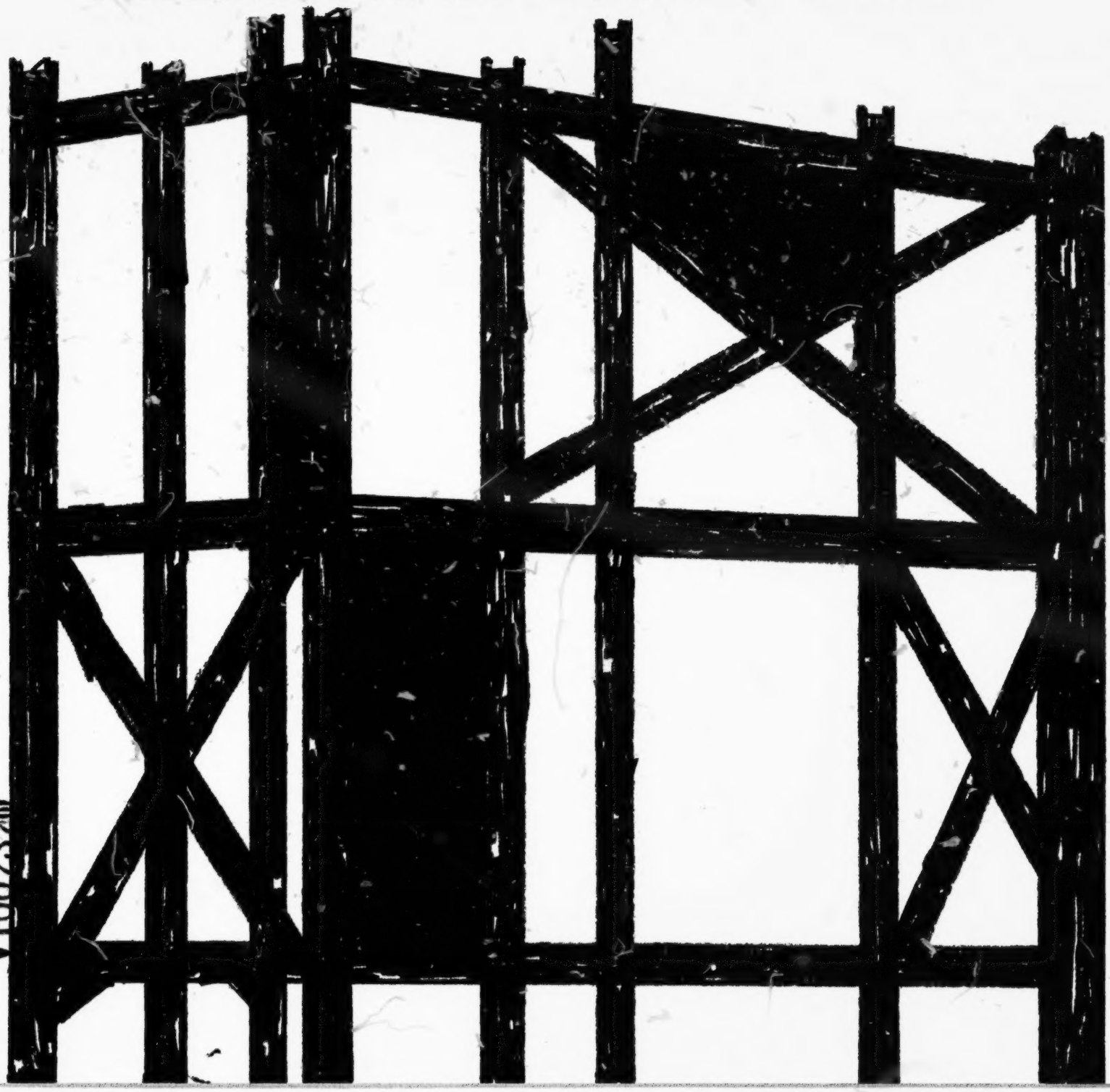
A GUIDE FOR PLANNING FACILITIES FOR OCCUPATIONAL PREPARATION PROGRAMS in the MACHINE TRADES



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1. To provide continuing reappraisal of the role and function of vocational and technical education in our democratic society;

2. To stimulate and strengthen state, regional, and national programs of applied research and development directed toward the solution of pressing problems in vocational and technical education;

3. To encourage the development of research to improve vocational and technical education in institutions of higher education and other appropriate settings;

4. To conduct research studies directed toward the development of new knowledge and new applications of existing knowledge in vocational and technical education;

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RESEARCH 24

Interim Report
Grant No. OEG 3-7-000158-2037

A GUIDE FOR PLANNING FACILITIES FOR OCCUPATIONAL PREPARATION PROGRAMS IN THE MACHINE TRADES

Interim Report.

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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FOREWORD

One of the most fundamental concerns in planning for vocational and technical education facilities is that of assuring that educational requirements dictate the nature of the facilities. Other concerns include planning a sufficiently adaptable and flexible structure to permit needed modifications and programmatic changes over the lifetime of the building. Experiences have shown that adequate manuals and guide materials can provide substantial assistance in planning educational facilities. This document is a guide for planning facilities for occupational preparation programs in the machine trades. The information recorded in the guide is to be used in the preparation of educational specifications.

The guide lists a series of pivotal questions about the educational program to be offered. The answers to these program questions bear directly on the numbers and kinds of instructional areas needed in the contemplated facilities. After program decisions are recorded, the guide provides for the description of instructional areas needed to meet program requirements. Much of the material is presented in a checklist format which allows for consideration of alternatives in facility planning.

The guide was designed for use by any person or groups of persons responsible for planning occupational programs in the machine trades. It is anticipated that knowledgeable persons such as machine trades instructors, state supervisors, university school plant planners, and local administrators will find the guide a useful planning tool. The guide can also be used for instructional purposes at universities, colleges, seminars, and institutes.

This guide is the second in a series being developed by The Center. Subsequent guides will be published for animal science technology, automotive trades, business and office occupations, data processing, dental technology, electrical technology, medical technology, and metallurgy. The first guide developed was in the field of home economics.

The Center for Vocational and Technical Education, The Ohio State University worked cooperatively with Dr. Milton E. Larson, Department of Vocational Education, Colorado State University in developing this planning guide. Center staff project members, Dr. Richard F. Meckley, Ivan E. Valentine, and Zane McCoy worked cooperatively with Dr. M. J. Conrad of the Administration and Facilities Unit.

The project staff is grateful to the many individuals and groups whose assistance and suggestions led to the successful conclusion of the project.

Robert E. Taylor, Director
The Center for Vocational
and Technical Education

CONTENTS

PART I INTRODUCTION

3 Purpose of Guide
3 Organization of Guide
4 Underlying Assumptions
4 Guiding Principles

PART II THE INSTRUCTIONAL PROGRAM

7 Basic Program Features
9 Educational Objectives
14 Program Content Areas
15 Planning Instructional Areas by Modes of Learning
17 Occupational Preparation Programs to be Offered
18 Instructions for Completing Form A
21 Form A--Basic Program Information

PART III DISTINCT TYPES OF INSTRUCTIONAL AREAS TO BE PROVIDED

25 Quantitative Facility Needs
27 Instructions for Completing Form B
29 Form B--Lecture/Demonstration Area Requirements by Content Areas
31 Instructions for Completing Form C
33 Form C--Seminar Area Requirements by Content Areas
35 Instructions for Completing Form D
37 Form D--Laboratory Area Requirements by Content Areas
39 Form E--Summary of Facility Requirements for Vocational Machine Tool Operation, Machine Shop, and Tool and Die Making
41 Qualitative Facility Needs
42 Form F--Description of Lecture/Demonstration Area(s)
46 Form G--Description of Seminar Area(s)
49 Form H--Description of Machine Shop/Laboratory Area(s)
58 Form I--Description of Blueprint Reading and Shop Drawing Area(s)
64 Form J--Additional Planning Considerations

PART IV ANNOTATED BIBLIOGRAPHY

65 General Facility Planning
68 Vocational-Technical Facility Planning
70 Metal Trades Facility Planning

A GUIDE FOR PLANNING FACILITIES FOR OCCUPATIONAL PREPARATION PROGRAMS IN THE MACHINE TRADES

FORMS A B C D E F G H I J

PART I

INTRODUCTION

PURPOSE OF GUIDE

The major purpose of this guide is to elicit the necessary information for the writing of educational specifications for facilities to house needed vocational programs in machine tool operation, machine shop, and tool and die making.

In addition to the major purpose of providing important and comprehensive information to be incorporated in educational specifications, the guide is also designed to:

- Assist planners in the formation of creative solutions to the housing of desired educational programs.
- Prevent important considerations from being overlooked in the facility planning process.
- Encourage logical and systematic facility planning.

ORGANIZATION OF GUIDE

The facility planning guide is organized under four major headings or parts. Part I (Introduction) is a discussion of the major purpose, the underlying assumptions, and the guiding principles which were utilized in the preparation of the guide.

In Part II (The Instructional Program) important information is sought on the machine shop department basic program features, objectives, and the kinds of occupational programs which will be organized to implement them.

In Part III (Distinct Types of Instructional Areas to be Provided) the actual spaces desired to house the vocational programs are described in detail.

Part IV is an annotated bibliography of reference sources which offer a more detailed treatment of the various phases of facility planning.

UNDERLYING ASSUMPTIONS

Important assumptions were made in the preparation of this guide. They were:

- Major educational program decisions have or are being made. Content of instruction has been determined through educational surveys, advisory committees, school board study, etc. Instructional methods have been determined by qualified machine shop and other appropriate staff members. To assure adequate educational program planning, the guide will ask important questions which may serve as guidelines to such planning.

- The numbers and kinds of students to be served by the program are generally known. Such information has been provided by enrollment projections, housing patterns, census data, student interests studies, etc.

- The information recorded in this guide will be used in the preparation of educational specifications for use by an architect in facility design.

- Sufficient finances are available to support both the provision of facilities and to operate the kinds of educational program outlined in the guide.

GUIDING PRINCIPLES

In planning facilities to house programs of vocational machine tool operation, machine shop, and tool and die making, it is suggested that educational program and facility decisions be consistent with the following guiding principles.

1. The educational program is the basis for planning space and facilities.

2. Space and facilities should be planned to accommodate changes in the educational program.

3. The program is planned to serve the needs of a variety of groups in the community.

4. Space and facilities for the program can be extended through the use of community resources.

5. Expanded programs to reach not only the average and those who are college bound, but also the unusually gifted, the physically handicapped, the mentally retarded and the culturally deprived are needed in vocational machine tool operation, machine shop, and tool and die making.

6. Cooperation among teachers in developing inter-disciplinary units or courses is encouraged by the proximity, flexibility, and convenience of classrooms and work areas where teachers can plan together and produce materials.

7. Safe and healthful housing should be provided for all students.

8. Mobile equipment, used where practical, with convenient space for storing it, adds to flexibility and often results in more efficient use of space.

9. The effective use of mechanical teaching aids, such as projectors, screens, recorders, and other devices, will depend upon the accessibility and convenience of storage.

10. Movable partitions, screens, folding doors, room dividers and portable furnishings and equipment can help in adjusting space requirements to meet specific needs.

11. Accessible convenient outdoor space adds to the flexibility of the department and car sometimes be effectively used to strengthen the educational program, as well as aid materials handling.

PART II

THE INSTRUCTIONAL PROGRAM

In Part II of the guide, important instructional program decisions with respect to basic program features, objectives, and needed information on occupational preparation programs to be housed are recorded.

BASIC PROGRAM FEATURES

Basic features of the educational program are determined greatly by a school or department's educational philosophy. A philosophy of education provides a base from which program objectives and teaching and learning activities designed to meet these objectives can be derived. In the final analysis, it is the kinds of teaching and learning activities to be carried on which should determine facility needs.

In this section, planners have an opportunity to express basic program features which will serve as guidelines for the planned occupational preparation programs in vocational machine tool operation, machine shop, and tool and die making.

Indicate below the relative degree of emphasis to be placed on each of the program features stated by circling the appropriate number. The scale provided for this purpose ranges from 1 for major emphasis, 2 for some emphasis, 3 for slight emphasis, to N for no emphasis. This same scale will be used frequently throughout the planning guide.

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. <u>Purpose of Program</u>

a. The purpose of the program will be the preparation of students for gainful employment.	1	2	3	N
b. The purpose of the program will be the upgrading of students presently employed in vocational machine tool	1	2	3	N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

operation, machine shop, and tool and die making.

c. The purpose of the program will be the preparation of students for entry into further training programs. The nature of this further training is:_____ 1 2 3 N
_____
_____

d. Other program purposes:
1) _____ 1 2 3 N
2) _____ 1 2 3 N
3) _____ 1 2 3 N
4) _____ 1 2 3 N

2. Students

a. Students will be selected for entrance into the program. 1 2 3 N
The basis for selection will be:
_____
_____

b. The program will place emphasis on skill acquisition. 1 2 3 N

c. The program will place emphasis on the learning of theory. 1 2 3 N

d. Students will have freedom of movement and access to learning materials. 1 2 3 N

e. Students will be encouraged to act independently. 1 2 3 N

f. Students will be provided with cooperative work experience outside the school. 1 2 3 N

g. Other basic program features in relation to students:
1) _____ 1 2 3 N
2) _____ 1 2 3 N
3) _____ 1 2 3 N
4) _____ 1 2 3 N

3. Instruction

a. The instructional approach will be single discipline (machine trades) as opposed to inter-disciplinary 1 2 3 N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

(machine trades, sheet metal, welding, etc.). If not a single discipline approach, describe the inter-disciplinary approach and the disciplines involved:

_____
_____
_____

b. Cooperative or team instruction will be used. If this mode of instruction is to be extensively emphasized, describe in general terms: _____ 1 2 3 N
_____

c. Community resources will be utilized in instruction. If a high emphasis is to be placed on use of community resources, describe some of these resources: _____ 1 2 3 N
_____
_____

d. Instructional flexibility is required. If a high emphasis is to be placed on instructional flexibility please describe the kinds of flexibility desired: 1 2 3 N

_____
_____
_____

4. Other basic program features important to the planned instructional program are:

a. _____ 1 2 3 N
_____

b. _____ 1 2 3 N
_____

c. _____ 1 2 3 N
_____

d. _____ 1 2 3 N
_____
_____

EDUCATIONAL OBJECTIVES

Educational objectives are often identified as goals or outcomes of the educational program. An objective should describe a desired educational outcome that is consistent with a school's philosophy.

Objectives are important to both the planner and the architect since they determine the school's program and related activities. They provide important implications which when translated into facilities can both enhance as well as adequately house the desired program. Thus it becomes imperative to establish clearly the

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

program objectives prior to embarking on educational specifications and subsequent building design.

The purpose of this part of the guide is to bring together these elements in a way to provide direction and understanding for both the planner and the architect. Space is provided below to indicate degree of emphasis by circling the appropriate number for each of the objectives, and to list additional objectives. The scale provided for this stated purpose ranges from 1 for major emphasis down to N for no emphasis.

1.	To prepare individuals for entry into gainful employment.	1	2	3	N
2.	To upgrade students presently employed in this vocational field.	1	2	3	N
3.	To update students desiring to return to the vocational field after employment in another vocation.	1	2	3	N
4.	To motivate and recruit capable and qualified students to enroll in post-high school institutions.	1	2	3	N
5.	To provide pre-professional educational training for students who plan to enter colleges and universities.	1	2	3	N
6.	To develop in students specific and measurable knowledge in dimensional and operational computations which include:				
	a. Measuring instruments	1	2	3	N
	b. Applied algebra	1	2	3	N
	c. Applied geometry	1	2	3	N
	d. Shop trigonometry	1	2	3	N
	e. Logarithms	1	2	3	N
	f. Slide rule	1	2	3	N
	g. _____	1	2	3	N
	h. _____	1	2	3	N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

7.	To develop in students specific and measurable knowledge and skills in blueprint reading and shop drawing which include:				
	a. Symbols and abbreviations	1	2	3	N
	b. American standard lines for drawings	1	2	3	N
	c. Views and sections	1	2	3	N
	d. Freehand detail drafting	1	2	3	N
	e. Orthographic projection	1	2	3	N
	f. Pictorial drawing	1	2	3	N
	g. Dimensioning	1	2	3	N
	h. _____	1	2	3	N
	i. _____	1	2	3	N
8.	To develop in students specific and measurable knowledge and skills in operation of machine tools which include:				
	a. Lathes	1	2	3	N
	b. Shapers	1	2	3	N
	c. Milling machines	1	2	3	N
	d. Grinders	1	2	3	N
	e. Drill presses	1	2	3	N
	f. Planers	1	2	3	N
	g. Boring machines	1	2	3	N
	h. Sawing and filing machines	1	2	3	N
	i. Broaching machines	1	2	3	N
	j. Gear machines	1	2	3	N
	k. Turret lathes and automatics	1	2	3	N
	l. Tracer machines	1	2	3	N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

m.	Numerical control machines	1	2	3	N
n.	_____	1	2	3	N
o.	_____	1	2	3	N

9. To develop in students specific and measurable knowledge and skills in bench work which includes:

a.	Hand tools	1	2	3	N
b.	Soldering	1	2	3	N
c.	Measuring tools	1	2	3	N
d.	_____	1	2	3	N
e.	_____	1	2	3	N

10. To develop in students specific and measurable knowledge and skills in inspection which includes:

a.	Line measurement	1	2	3	N
b.	Fixed gages	1	2	3	N
c.	Thread gages	1	2	3	N
d.	Dial gages and test indicators	1	2	3	N
e.	Gage blocks	1	2	3	N
f.	Comparison measurement	1	2	3	N
g.	Angular measurement	1	2	3	N
h.	Optical instruments	1	2	3	N
i.	Surface roughness measurements	1	2	3	N
j.	Micrometers and verniers	1	2	3	N
k.	Hardness testing	1	2	3	N
l.	_____	1	2	3	N
m.	_____	1	2	3	N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

11.	To develop in students specific and measurable knowledge and skills in heat treatment which includes:				
	a. Hardening	1	2	3	N
	b. Tempering	1	2	3	N
	c. Annealing	1	2	3	N
	d. Normalizing	1	2	3	N
	e. Case hardening	1	2	3	N
	f. _____	1	2	3	N
	g. _____	1	2	3	N
12.	To develop in students specific and measurable knowledge and skills in tool, die, and mold making which includes:				
	a. Allowances and tolerances	1	2	3	N
	b. Punch and die construction	1	2	3	N
	c. Tool making	1	2	3	N
	d. Jig and fixture construction	1	2	3	N
	e. Mold construction	1	2	3	N
	f. _____	1	2	3	N
	g. _____	1	2	3	N
13.	To develop in students specific and measurable knowledge and skills in related science for machine shop which includes:				
	a. Technical physics	1	2	3	N
	b. Technical chemistry	1	2	3	N
	c. Metallurgy	1	2	3	N
	d. _____	1	2	3	N
	e. _____	1	2	3	N

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

14. Other program objectives include:

a. _____ 1 2 3 N

b. _____ 1 2 3 N

c. _____ 1 2 3 N

d. _____ 1 2 3 N

PROGRAM CONTENT AREAS

The educational program in vocational machine tool operation, machine shop, and tool and die making should be designed to meet its established objectives. All decisions made with respect to educational programs should be consistent with established philosophy and objectives.

Instruction in the machine trades can be subdivided into three major categories of machine tool operation, machine shop, and tool and die making. While much overlapping occurs, increased skill and knowledge is required in progressing from the operation of a single machine tool to the performance of the total functions of a machinist. The tool and die maker requires the highest degree of skill and knowledge of the individuals employed in the machine trades. This guide is designed to assist in the planning of facilities for any or all of the above mentioned machine trades.

In the courses or units of instruction the emphasis is on the acquisition of skill, knowledge, habits, and attitudes desirable for employment in industry in the machine trades.

Learning activities and experiences are organized to enable students to develop competencies essential for entry into their chosen occupations, to further training, or to acquire new or additional competencies for upgrading in the trade.

Instruction in vocational machine tool operation, machine shop, and tool and die making is usually given in discrete subject areas or courses. The subject matter is coordinated with appropriate shop, laboratory and/or work experience.

Instructional programs in machine trades can be classified under two broad headings or content areas of 1) Machine Shop Theory and Practice and 2) Blueprint Reading and Shop Drawing. These two content areas relate directly to the field of vocational machine tool operation, machine shop, and tool and die making and can be used to categorize most occupational preparation programs in the field. Students in these programs often elect or are required to take courses in subjects such as English, social studies, and physical

education which are available to all students. For example, an eleventh grade student in training to become a machinist might take the following courses or units:

Courses	Content Areas
Machine Shop Theory and Practice I	Machine Shop
Related Mathematics I	Academic
English	Academic
Social Studies	Academic
Related Blueprint Reading I	Blueprint Reading and Drawing
Physical Education I	Physical Education

The concept of content areas is used in this planning guide because different instructional content areas usually call for different kinds of instructional facilities and equipment. Of the content areas for the machine trades only machine shop theory and practice require unique space and equipment, the other related subjects and general education subjects utilize equipment and space provided for other common or specialized curricula. In this guide complete development will be provided for the content area 1) Machine Shop Theory and Practice and 2) Blueprint Reading and Shop Drawing.

The following content areas which usually call for specialized instructional areas are used in this guide.

- Machine Shop Theory and Practice
- Blueprint Reading and Shop Drawing
- Academic (e.g., English, mathematics, science)
- Science (e.g., physics, chemistry, and biology)
- Music (e.g., band, chorus, and choir)
- Physical Education
- Other (this category is used in the event that a course or unit to be offered will not fit into any of the above content areas)

PLANNING INSTRUCTIONAL AREAS BY MODES OF LEARNING

The planning of instructional areas for vocational facilities can be substantially aided through utilization of the concept of modes of learning. Learning can be divided into three distinct modes--reaction learning, interaction learning, and action learning.

Reaction learning, which usually occurs in an instructional area designed for lecture and demonstration, is characterized by activities which tend to be largely teacher-centered with the central focus on instruction. Student activities include listening, observing, and the taking of notes. Group size for reaction learning may vary from one to a very large number as the number of students has little effect on the learning experience if proper technological aids such as television, microphones, projectors and the like are used. Because student activities are relatively passive in reaction learning, a short optimum time span is normally employed.

Lecture/demonstration areas are usually designed to be used commonly for reaction learning in all subject areas. For example, in planning facilities for two diverse occupational preparation programs for the machine trades such as Machine Shop Theory and Related Mathematics, the planner should bear in mind that reaction learning for students in both programs can occur in the same kind of instructional area. This means that facility planning should be done in terms of the total program rather than its fractional parts. In many instances, lecture/demonstration areas can be shared not only be occupational preparation programs within vocational service areas, but also by distinct and dissimilar service areas such as machine trades and distributive education. Where a great deal of facility sharing is planned, the planner should consider the relative merits of optimum location within the total building and the advisability of clustering various instructional areas.

Interaction learning, which usually occurs in a seminar-type instructional area, is characterized by both teacher and learner activity participating as both listener and speaker. This mode of learning, of course, must occur in groups; however, sociological research suggests these groups should not exceed fifteen persons for optimum effectiveness. Active interaction of all students generally requires a longer time span than reaction learning.

Seminar areas, like lecture/demonstration areas, are usually designed for common use by all vocational service areas. The same considerations which were outlined for lecture/demonstration areas also apply to seminar areas.

A modified seminar-type instructional area is frequently utilized for both interaction learning and reaction learning in classes of the machine trades sequence due to the small numbers of students in the instructional groups.

Action learning, which usually occurs in a shop or laboratory-type instructional area, is characterized by small group or individual student learning by doing. Although learning is done on an individual basis, students may, nevertheless, function in a group setting. Very often in more flexible types of educational programs, students may also be scheduled for shop or laboratory work on an individual basis. Since action learning involves overt action by individual students, the teacher's role is that of a demonstrator of correct procedures, supervisor for, and consultant to the learner.

Shop and laboratory instructional areas, of necessity, are more highly specialized than lecture/demonstration areas used for reaction learning and seminar areas used for interaction learning. However, some basic shop or laboratory equipment may need to be provided for in both lecture/demonstration areas and seminar areas to expedite the learning process. Since shop and laboratory areas are designed to facilitate the learning of specific vocational and technical skills, there is less likelihood of sharing such areas by students in various other vocational training programs. However, where common elements of shop and laboratory instruction are found among various vocational training programs, consideration should be

given to the possibility of sharing and clustering the shop and laboratory facilities. For this to work effectively consideration needs to be given to the philosophy of the vocational educators involved.

NOTE: THE FOLLOWING SECTIONS OF THE GUIDE (PAGES 18-37) ARE DESIGNED TO ASSIST IN MAKING MATHEMATICAL DETERMINATIONS OF THE NUMBER OF VARIOUS KINDS OF INSTRUCTIONAL AREAS NEEDED TO HOUSE THE DESIRED PROGRAM. IF THE NUMBERS OF INSTRUCTIONAL AREAS REQUIRED ARE ALREADY KNOWN, PLANNERS MAY NOW PROCEED DIRECTLY TO FORM E, PAGE 39. IF, HOWEVER, MATHEMATICAL DETERMINATIONS ARE TO BE MADE, ALL FORMS SHOULD BE COMPLETED AS ACCURATELY AS POSSIBLE.

OCCUPATIONAL PREPARATION PROGRAMS TO BE OFFERED

Information on each of the machine trades occupational preparation programs to be offered is entered on a separate Form A which follows. Directions for completing Form A(s) appear on pages 18 and 19. To assist planners, a sample, completed Form A is given on on page 20. Data entered in the sample Form A are for a machinist training program. The data were assumed for purpose of illustration. Some other occupational preparation programs commonly offered in the vocational service area of the machine trades include lathe operator, turret lathe operator, milling machine operator, shaper operator, grinder operator, quality assurance inspector, mold maker, tool maker, and die maker.

Form A for each occupational preparation program should be filled out as completely as possible. However, it is realized, for example, that a machine trades instructor completing Form A may be unaware of time allotments and methods of instruction in other subject areas. If such is the case, the instructor can only supply information on courses within the content areas of the machine trades.

INSTRUCTIONS FOR COMPLETING FORM A
BASIC PROGRAM INFORMATION

Item 1

Occupational Program--Enter here the name of the occupational program to be offered, e.g., machinist, lathe operator, milling machine operator, tool and die maker, etc. Complete a separate Form A for each occupational program to be offered.

Item 2

Yearly Enrollment--Enter here the projected maximum number of students to be enrolled yearly in the program.

Item 3

Nature of Students--Underline all categories which apply to the students to be enrolled in the program.

Item 4

Weeks of Instruction per year--Enter here the number of weeks per year the school will be open for instruction, e.g., 36 weeks, 52 weeks.

Item 5

Total Weekly Periods or Modules--Enter here the total number of periods or modules (if modular scheduling is to be used) per week available for instructional purposes for each student. Do not count periods or modules scheduled for lunch and other non-instructional purposes.

Column 6

Course of Instruction--List the courses or units of instruction to be offered either on a required or elective basis for the occupational program.

Column 7

Content Area--Opposite each course of instruction, enter the appropriate content area as presented on page 15.

Column 8

Total Course Enrollment--Opposite each course of instruction, enter the projected maximum student enrollment.

Column 9

Maximum Group Size for Reaction Learning--Opposite each course or unit of instruction, enter the maximum group size in number of students for reaction (lecture/demonstration) type learning.

Column 10

Estimated Weekly Periods or Modules of Reaction Level Learning--Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devoted to reaction learning per student.

Column 11

Weekly Group-Periods or Modules (Lecture/Demonstration)--To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 9 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 10.

Column 12

Maximum Group Size for Interaction Learning--Opposite each course or unit of instruction, enter the maximum group size in number of students for interaction (seminary) type learning

Column 13

Estimated Weekly Periods or Modules of Interaction Level Learning--Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devote to interaction learning per student.

Column 14

Weekly Group-Periods or Modules (Seminar)--To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 12 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 13.

Column 15

Maximum Group Size for Action Learning--Opposite each course or unit of instruction, enter the maximum group size in number of students for action (shop/laboratory) type learning.

Column 16

Estimated Weekly Periods or Modules of Action Level Learning--Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devoted to action learning per student.

Column 17

Weekly Group-Periods or Modules (Shop/Laboratory)--To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 15 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 16.

SAMPLE FORM A

BASIC PROGRAM INFORMATION

1. Occupational Program *Machinist*

2. Yearly Enrollment *60*

3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) _____

4. Weeks of Instruction per year *36*

5. Total Weekly Periods or Modules *30*

Courses of Instruction	Content Areas	Total Course Enrollment	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Period-Modules by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Mach. Shop 1	*Mach.Shop*	*30*	*30*	*1*	*1*	*15*	*4*	*8*	*15*	*10*	*20*
Mach. Shop 2	*Mach.Shop*	*30*	*30*	*1*	*1*	*15*	*3*	*6*	*15*	*15*	*30*
Rel. Math. 1	*Academic*	*30*	*60*	*1*	*1*	*15*	*3*	*6*	*0*	*0*	*0*
Rel. Math. 2	*Academic*	*30*	*60*	*1*	*1*	*15*	*3*	*6*	*0*	*0*	*0*
Blueprint Rd.	*Blue.Read.*	*30*	*30*	*1*	*1*	*15*	*2*	*4*	*0*	*0*	*0*
Shop Drawing	*Blue.Read.*	*30*	*30*	*1*	*1*	*15*	*1*	*2*	*30*	*8*	*8*
English	*Academic*	*60*	*60*	*2*	*2*	*15*	*1*	*2*	*0*	*0*	*0*
Amer. History	*Academic*	*60*	*60*	*4*	*4*	*0*	*0*	*0*	*0*	*0*	*0*
Phys. Ed. 1	*Phys. Ed.*	*30*	*25*	*1*	*2*	*15*	*1*	*2*	*20*	*3*	*6*
Phys. Ed. 2	*Phys. Ed.*	*20*	*25*	*1*	*1*	*15*	*1*	*2*	*20*	*3*	*6*

[1]If both day and night school are to be offered, fill out separate forms for each.
*(Lecture/demonstration)
**(Seminar)
***(Shop/Laboratory)

FORM A

BASIC PROGRAM INFORMATION

1. Occupational Program _____

2. Yearly Enrollment _____

3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) _____

4. Weeks of Instruction per year _____

5. Total Weekly Periods or Modules _____

Courses of Instruction	Content Areas	Total Course Enrollment	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Period-Modules by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)

[1]If both day and night school are to be offered, fill out separate forms for each.
*(Lecture/demonstration)
**(Seminar)
***(Shop/Laboratory)

FORM A

FORM A

BASIC PROGRAM INFORMATION

1. Occupational Program _____

2. Yearly Enrollment _____

3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) _____

4. Weeks of Instruction per year _____

5. Total Weekly Periods or Modules _____

Courses of Instruction	Content Areas	Total Course Enrollment	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Period-Modules by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)

[1]If both day and night school are to be offered, fill out separate forms for each.
*(Lecture/demonstration)
**(Seminar)
***(Shop/Laboratory)

FORM A

BASIC PROGRAM INFORMATION

1. Occupational Program _____

2. Yearly Enrollment _____

3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) _____

4. Weeks of Instruction per year _____

5. Total Weekly Periods or Modules _____

Courses of Instruction	Content Areas	Total Course Enrollment	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Period-Modules by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)

[1]If both day and night school are to be offered, fill out separate forms for each.
*(Lecture/demonstration)
**(Seminar)
***(Shop/Laboratory)

FORM A

BASIC PROGRAM INFORMATION

1. Occupational Program _____

2. Yearly Enrollment _____

3. Nature of Students (underline appropriate categories): a. day school[1]; b. night school[1]; c. school age; d. adults; e. males; f. females; other (specify) _____

4. Weeks of Instruction per year _____

5. Total Weekly Periods or Modules _____

Courses of Instruction	Content Areas	Total Course Enrollment	Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Period-Modules by Levels of Learning								
			REACTION*			INTERACTION**			ACTION***		
			Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules	Maximum Group Size	Weekly Periods or Modules	Weekly Group-Periods or Modules
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)

[1]If both day and night school are to be offered, fill out separate forms for each.
*(Lecture/demonstration)
**(Seminar)
***(Shop/Laboratory)

FORM A

PART III

DISTINCT TYPES OF INSTRUCTIONAL AREAS AREAS TO BE PROVIDED

QUANTITATIVE FACILITY NEEDS

The number of instructional areas to house the programs described in Part II (The Instructional Program) are recorded in this section of the guide.

As indicated in Part II, there are three principal types of instructional areas used to accommodate educational programs. They are:

Lecture/demonstration areas--used principally for group reaction learning;

Seminar areas--used principally for group interaction learning; and

Shop/laboratory areas--used principally for group or individual action learning.

In addition to these instructional areas, there are, of course, other school-wide auxiliary areas such as instructional materials centers, language laboratories, gymnasiums, and auditoriums which are part of the overall school plan. Requirements for such facilities are calculated as a part of total school planning and are not made in this guide.

It is recommended that facility needs, including occupational programs such as vocational machine tool operation, machine shop, and tool and die making, be made on a school-wide basis in order to provide planners with a balanced picture of the building to be constructed and in order to provide economy and convenience through the sharing and clustering of various kinds of facilities and equipment.

Forms B, C, and D can be used to compute the number of lecture/demonstration, seminar, and shop/laboratory areas required, respectively for the planned programs in the machine trades. The use of these forms requires some mathematical ability. Personnel responsible for completing the guide may want to utilize the services of individuals with this special competence.

Results of the computations on Forms B, C, and D are entered on Form E which is a summary of total instructional area requirements for vocational machine tool operation, machine shop, and tool and die making.

In the event that instructional area requirements are already determined (e.g., it has been decided that one combination shop/laboratory and lecture/demonstration area will be provided) the information can be recorded directly on Form E without making the computations on Forms B, C, and D.

It is strongly recommended that appropriate personnel be utilized to ensure that the number of instructional areas is sufficient to meet program requirements. After the number of each type of instructional area is determined and recorded on Form E, information can then be recorded in the following sections of the guide concerning the nature of these instructional areas.

INSTRUCTIONS FOR COMPLETING FORM B

LECTURE/DEMONSTRATION AREA REQUIREMENTS BY CONTENT AREAS

Column 1

Content Area--Content areas are listed in Column 1.

Column 2

Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each content area as indicated in Columns 7 and 8 of Form A(s) for all occupational programs.

Column 3

Maximum Group Size--Opposite each content area, enter the maximum group size desired for a lecture/demonstration area to serve the content area (Form A, Column 9).

Column 4

Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5

Total Weekly Reaction Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to reaction learning as indicated in Column 11 of Form A(s) for all occupational programs.

Column 6

Lecture/Demonstration Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7

Adjusted Lecture/Demonstration Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.

Column 8

Totals--Since lecture/demonstration areas, unlike shop/laboratory areas, can be utilized by nearly all content areas, the entries in Column 7 can be added for all lecture/demonstration areas with identical maximum group sizes as entered in Column 3. For example, 8a might read 2 lecture/demonstration areas with a student capacity of 50 each.

SAMPLE FORM B

LECTURE/DEMONSTRATION AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Wkly. Periods or Modules (4)	Total Weekly Reaction Group-Periods, Modules (5)	Lecture/Demonstration Areas Required (5) ÷ (4) (6)	Adjusted Lecture/ Demonstration Areas Required (6) x 1.3 (7)
Machine Shop Theory & Practice	60	30	30	2	0.07	0.09
Blueprint Reading & Shop Drawing	60	30	30	2	0.07	0.09
Academic	240	60	30	8	0.27	0.35
Music	---	---	---	---	---	---
Physical Ed.	50	25	30	3	0.10	0.13
Other (specify)	---	---	---	---	---	---

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3). Round off total to next higher whole number.

a. 1 lecture/demonstration areas with a student capacity of 30, each.
b. 1 lecture/demonstration areas with a student capacity of 60, each.
c. 1 lecture/demonstration areas with a student capacity of 25, each.
d. _____ lecture/demonstration areas with a student capacity of _____, each.

Note: The entries in Column 7 indicate clearly that the lecture/demonstration areas would only be used sparingly by students enrolled in each of the content areas. One possibility might be construction of a lecture/demonstration area with a student capacity of 60 which could be subdivided to meet program requirements of all content areas. Another possibility would be the sharing of lecture/demonstration areas with other students enrolled in various other programs.

FORM B

LECTURE/DEMONSTRATION AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Wkly. Periods or Modules (4)	Total Weekly Reaction Group-Periods, Modules (5)	Lecture/Demonstration Areas Required (5) ÷ (4) (6)	Adjusted Lecture/ Demonstration Areas Required (6) x 1.3 (7)
Machine Shop Theory & Practice						
Blueprint Reading & Shop Drawing						
Academic						
Music						
Physical Ed.						
Other (specify)						

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3). Round off total to next higher whole number.

a. _____ lecture/demonstration areas with a student capacity of _____, each.
b. _____ lecture/demonstration areas with a student capacity of _____, each.
c. _____ lecture/demonstration areas with a student capacity of _____, each.
d. _____ lecture/demonstration areas with a student capacity of _____, each.

INSTRUCTIONS FOR COMPLETING FORM C

SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

Column 1
Content Area--Content areas are listed in Column 1.

Column 2
Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each content area indicated in Column 7 and 8 of Form A(s) for all occupational programs.

Column 3
Maximum Group Size--Opposite each content area, enter the maximum group size desired for a seminar area to serve the content area (Form A, Column 12).

Column 4
Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5
Total Weekly Interaction Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to interaction learning as indicated in Column 14 of Form A(s) for all occupational preparation programs.

Column 6
Seminar Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7
Adjusted Seminar Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.

Column 8
Totals--Since seminar areas, unlike shop/laboratory areas, can be commonly utilized by nearly all content areas, the entries in Column 8 can be added for all seminar areas with identical maximum group sizes or entered in Column 3. For example, 8a might read __2__ seminar areas with a student capacity of __20__, each.

SAMPLE FORM C

SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Periods or Modules (4)	Total Weekly Interaction Group-Periods or Modules (5)	Seminar Areas Required (5) ÷ (4) (6)	Adjusted Seminar Areas Required (6) x 1.3 (7)
Machine Shop Theory & Practice	*60*	*15*	*30*	*14*	*0.47*	*0.61*
Blueprint Reading & Shop Drawing	*60*	*15*	*30*	*6*	*0.20*	*0.26*
Academic	*240*	*15*	*30*	*14*	*0.47*	*0.61*
Music	---	---	---	---	---	---
Physical Ed.	*50*	*15*	*30*	*4*	*0.14*	*0.18*
Other (specify)	---	---	---	---	---	---

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3). Round up total to next higher whole number.

a. *2* seminar areas with a minimum student capacity of *15*, each.
b. _____ seminar areas with a minimum student capacity of _____, each.
c. _____ seminar areas with a minimum student capacity of _____, each.
d. _____ seminar areas with a minimum student capacity of _____, each.

SAMPLE FORM C

FORM C

SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Periods or Modules (4)	Total Weekly Interaction Group-Periods or Modules (5)	Seminar Areas Required (5) ÷ (4) (6)	Adjusted Seminar Areas Required (6) x 1.3 (7)
Machine Shop Theory & Practice						
Blueprint Reading & Shop Drawing						
Academic						
Music						
Physical Ed.						
Other (specify)						

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3). Round up total to next higher whole number.

a. _____ seminar areas with a minimum student capacity of _____, each.
b. _____ seminar areas with a minimum student capacity of _____, each.
c. _____ seminar areas with a minimum student capacity of _____, each.
d. _____ seminar areas with a minimum student capacity of _____, each.

INSTRUCTIONS FOR COMPLETING FORM D

SHOP/LABORATORY AREA REQUIREMENTS BY CONTENT AREAS

Column 1

Content Area--Content areas are listed in Column 1.

Column 2

Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each area as indicated in Columns 5 and 6 of Form A for all occupational programs.

Column 3

Maximum Group Size--Opposite each content area, enter the maximum group size desired for a shop/laboratory area to serve the content area (Form A, Column 15).

Column 4

Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5

Total Weekly Action Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to action learning as indicated in Column 17 of Form A(s) for all occupational programs.

Column 6

Shop/laboratory Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7

Adjusted Shop/laboratory Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.

SAMPLE FORM D

SHOP/LABORATORY AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Period or Modules (4)	Total Weekly Action Group-Periods or Modules (5)	Areas Required (5) ÷ (4) (6)	Adjusted Areas Required (6) x 1.3 (7)
Machine Shop Theory & Practice	*60*	*30*	*30*	*60*	*2.00*	*2.60*
Blueprint Reading & Shop Drawing	*60*	*30*	*30*	*8*	*0.27*	*0.35*
Academic	*240*	*60*	*30*	*0*	---	---
Music	---	---	---	---	---	---
Physical Ed.	*50*	*25*	*30*	*12*	*0.40*	*0.52*
Other (specify)	---	---	---	---	---	---

SAMPLE FORM D

FORM D

SHOP/LABORATORY AREA REQUIREMENTS BY CONTENT AREAS

Content Area (1)	Total Enrollment (2)	Maximum Group Size (3)	Total Weekly Period or Modules (4)	Total Weekly Action Group-Periods or Modules (5)	Areas Required (5) ÷ (4) (6)	Adjusted Areas Required (6) x 1.3 (7)
Machine Shop Theory & Practice						
Blueprint Reading & Shop Drawing						
Academic						
Music						
Physical Ed.						
Other (specify)						

SAMPLE FORM E

SUMMARY OF FACILITY REQUIREMENTS FOR VOCATIONAL MACHINE TOOL OPERATION, MACHINE SHOP, AND TOOL AND DIE MAKING

Instructional Areas	Number Required*		Required Student Capacity
	Calculated Forms B, C, D Column 7	Next Higher Whole Number	
Lecture/Demonstration	*0.35*	*1.00*	*60*
1 Lecture/Demonstration			
Lecture/Demonstration			
Lecture/Demonstration			
Seminar	*1.66*	*2.00*	*15*
2 Seminar			
Seminar			
Seminar			
Machine Shop Theory & Practice Laboratory	*2.60*	*3.00*	*30*
3 Machine Shop Theory & Practice Laboratory			
Blueprint Reading & Shop Drawing			
Music Laboratory			
Physical Education Laboratory			

4 Multi-purpose areas

If any of the specialized areas entered above are to be combined as multi-purpose areas, indicate the combinations desired.

a. *Machine Shop Theory and Practice Laboratory and Seminar Area*
b. _____
c. _____
d. _____

5 Summary of facility requirements for machine tool operation, machine shop, and tool and die making training program requirements. Based on the above entries, summarize the total quantitative facility requirements for the planned program.

_____
_____
_____

*Enter the number of instructional areas needed for each student capacity required. In the event that the numbers required indicate that an area will be used only sparingly, consideration should be given to sharing lecture/demonstration and seminar areas with other training programs or the construction of high student capacity areas which are capable of being subdivided for instructional purposes.

FORM E

SUMMARY OF FACILITY REQUIREMENTS FOR VOCATIONAL MACHINE TOOL OPERATION, MACHINE SHOP, AND TOOL AND DIE MAKING

	Instructional Areas	Number Required*		Required Student Capacity
		Calculated Forms B, C, D Column 7	Next Higher Whole Number	
1	Lecture/Demonstration			
	Lecture/Demonstration			
	Lecture/Demonstration			
	Lecture/Demonstration			
2	Seminar			
	Seminar			
	Seminar			
	Seminar			
3	Machine Shop Theory & Practice Laboratory			
	Machine Shop Theory & Practice Laboratory			
	Blueprint Reading & Shop Drawing			
	Music Laboratory			
	Physical Education Laboratory			

4 Multi-purpose areas

If any of the specialized areas entered above are to be combined as multi-purpose areas, indicate the combinations desired.

a. _____
b. _____
c. _____
d. _____

5 Summary of facility requirements for machine tool operation, machine shop, and tool and die making training program requirements. Based on the above entries, summarize the total quantitative facility requirements for the planned program.

_____
_____
_____

*Enter the number of instructional areas needed for each student capacity required. In the event that the numbers required indicate that an area will be used only sparingly, consideration should be given to sharing lecture/demonstration and seminar areas with other training programs or the construction of high student capacity areas which are capable of being subdivided for instructional purposes.

QUALITATIVE FACILITY NEEDS

In this section, detailed information on the kind of instructional areas required is recorded. Special forms are provided for describing the nature of lecture/demonstration areas, seminar areas, shop/laboratory areas, and auxiliary areas to be provided. For each general type of instructional area required information is sought in the following categories.

1. The relationship of the area to other instructional areas (specialized vs. multi-purpose utilization of space)

2. The number of these kinds of areas needed

3. The activities of students and teachers in the instructional area

4. The spatial relationships within the area and the area's spatial relationships to other instructional areas and the building as a whole

5. The furniture and equipment required for the area

6. The environmental factors required for the area

7. The special utility services required for the area

8. The minimal space requirements for the area

FORM F

DESCRIPTION OF LECTURE/DEMONSTRATION AREA(S) TO BE USED PRINCIPALLY FOR GROUP REACTION LEARNING

1. The lecture/demonstration area(s) should be planned:

a.	As independent unit(s)	Yes	No
b.	In combination with _____ shop/laboratory area(s) (specify)		
c.	In combination with seminar area(s)	Yes	No
d.	As an area within a single multi-purpose space	Yes	No

2. Number of lecture/demonstration areas required for the desired program regardless of student capacity (See Form E). _____

3. Student and teacher activities in this space. Indicate the extent to which each of the activities listed below will occur.

a.	Listening to lectures	1	2	3	N
b.	Observing demonstrations	1	2	3	N
c.	Taking notes	1	2	3	N
d.	Viewing films, slides, overhead projections, etc.	1	2	3	N
e.	Viewing closed-circuit television	1	2	3	N
f.	Using computer-assisted instruction	1	2	3	N
g.	_____	1	2	3	N
h.	_____	1	2	3	N

4. Spatial relationships. Indicate the extent to which the lecture/demonstration area(s) should be accessible to the:

a.	Instructional materials center	1	2	3	N
b.	Building entrance	1	2	3	N
c.	Delivery area	1	2	3	N
d.	Other instructional areas				
	1) _____	1	2	3	N
	2) _____	1	2	3	N
	3) _____	1	2	3	N
e.	Other building areas				
	1) _____	1	2	3	N
	2) _____	1	2	3	N
	3) _____	1	2	3	N

5. Furniture and equipment

a.	Student seating			
	1) Individual desks and chairs	P	A	NA*

*Code: P = Preferred; A = Acceptable; NA = Not Acceptable. This is used frequently throughout this part of the guide.

a) Number of desks and chairs required
b) Provision for storage — Yes No

2) Permanent-type desks — P A NA
a) Number required
b) Provision for storage — Yes No

3) Desk and chair combination — P A NA
a) Number required
b) Provision for storage — Yes No

4) Tables and chairs — P A NA
a) Number of tables required
b) Number of chairs required
c) Provision for storage — Yes No

5) Auditorium-type seating — P A NA
Number of seats required

b. Stage — Yes No
1) Permanent type — P A NA
2) Portable type — P A NA
The approximate area in square feet desired

c. Sound amplifying system — P A NA

d. Controls for regulating light intensity — P A NA

e. Lectern
1) Permanent type — P A NA
2) Portable type — P A NA
3) Provision for storage — Yes No

f. Projection screen
1) Built-in type — P A PA
2) Portable type — P A PA
3) Combination projection screen, chalkboard, and tackboard — P A NA
4) Approximate dimensions
5) Provision for storage — Yes No

g. Other equipment required for lecture/demonstration area(s) are:
1) _____
2) _____
3) _____
4) _____

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the lecture/demonstration area(s).

_____
_____
_____

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the lecture/demonstration area(s).

_____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the lecture/demonstration area(s).

_____
_____
_____
_____

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound systems. Indicate any special consideration important to the planning of the lecture/demonstration area(s).

_____
_____
_____
_____

e. Safety. In planning a school building, safety for students and teachers is of prime concern. Indicate any special safety considerations which have implications for design of the lecture/demonstration area(s).

_____
_____
_____
_____

7. Vertical instructional surfaces

a.	Chalkboard		Yes	No
	1) Wall-mounted	P	A	NA
	2) Number of lineal feet			
	3) Portable	P	A	NA
	4) Provision for storage		Yes	No
b.	Tackboard	P	A	NA
	Number of lineal feet			
c.	Pegboard	P	A	NA
	Number of lineal feet			

8. Special utility services required

a.	Electricity		
	1) Projection equipment	Yes	No
	2) Sound amplifying equipment	Yes	No
	3) Electrical needs for other equipment (specify)		
	a) _____		
	b) _____		
	c) _____		
	d) _____		

b. Other utility needs for the lecture/demonstration area

1) _____
2) _____
3) _____
4) _____

9. The minimal space requirement in square feet for each lecture/demonstration area. (Optional) _____ (The planner should be aware of any state or local regulation or recommendations concerning floor space requirements.)

10. Other important factors to be considered in the planning of the lecture/demonstration area(s) are:

_____
_____
_____
_____
_____
_____
_____
_____
_____

FORM G

DESCRIPTION OF SEMINAR AREA(S) TO BE USED PRINCIPALLY FOR GROUP INTERACTION LEARNING

1. The seminar area(s) should be planned:

a.	As independent unit(s)	Yes	No
b.	In combination with _____ shop/laboratory area(s) (specify)		
c.	In combination with lecture/demonstration area(s)	Yes	No
d.	As an area within a single multi-purpose space	Yes	No

2. The number of seminar area(s) required for the desired program regardless of student capacity (See Form E) _____

3. Student and teacher activities in this space. Indicate the extent to which each of the activities listed below will occur.

a.	Small group discussing	1	2	3	N
b.	Viewing films, slides, overhead projections, etc.	1	2	3	N
c.	Demonstrating	1	2	3	N
d.	Reporting	1	2	3	N
e.	Working on projects or jobs	1	2	3	N
f.	_____	1	2	3	N
g.	_____	1	2	3	N

4. Spatial relationships. Indicate the extent to which the seminar area(s) should be accessible to the:

a.	Instructional materials center	1	2	3	N
b.	Building entrance	1	2	3	N
c.	Delivery area	1	2	3	N
d.	Other instructional areas				
	1) _____	1	2	3	N
	2) _____	1	2	3	N
	3) _____	1	2	3	N
e.	Other building areas				
	1) _____	1	2	3	N
	2) _____	1	2	3	N
	3) _____	1	2	3	N

5. Furniture and equipment

a.	Seminar table	Yes		No
	1) Number required	_____		
	2) Seating for how many persons	_____		
	3) Permanent type	P	A	NA
	4) Portable type	P	A	NA
	5) Provision for storage	Yes		No
b.	Chairs			
	1) Number required	_____		
	2) Straight-back type	P	A	NA
	3) Folding type	P	A	NA

4) Provision for storage Yes No

c. Other equipment required for seminar area(s) are:
1) _____
2) _____
3) _____

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of seminar areas.

_____
_____
_____
_____

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the seminar area(s).

_____
_____
_____
_____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the seminar area(s).

_____
_____
_____
_____

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the seminar area(s).

_____
_____
_____
_____

e. Safety. In planning a school building, safety for students and teachers is of prime concern. Indicate any special safety considerations which have implications for design of the seminar area(s).

_____
_____
_____
_____

7. Vertical instructional surfaces

a.	Chalkboard		Yes	No
	1) Wall-mounted	P	A	NA
	2) Number of lineal feet			
	3) Portable	P	A	NA
	4) Provision for storage		Yes	No
b.	Tackboard	P	A	NA
	Number of lineal feet			
c.	Pegboard	P	A	NA
	Number of lineal feet			

8. Special utility services required

a. Electricity
   1) Projection equipment — Yes No
   2) Sound amplifying equipment — Yes No
   3) Electrical needs for other equipment (specify)
      a) _____
      b) _____
      c) _____
      d) _____

b. Other utility needs for the seminar area(s)
   1) _____
   2) _____
   3) _____
   4) _____

9. Minimal space requirement in square feet for each seminar area. (Optional) _____ (The planner should be aware of any state or local regulations or recommendations concerning floor space requirements.)

10. Other important factors to be considered in the planning of the seminar area(s) are:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

FORM H

DESCRIPTION OF MACHINE SHOP THEORY AND PRACTICE
LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING

1. The Machine/Shop/Laboratory Area(s) should be planned:

a. As independent unit(s)	Yes	No
b. In combination with _____ shop/laboratory area(s) (specify)		
c. In combination with seminar area(s)	Yes	No
d. In combination with lecture/demonstration area(s)	Yes	No
e. As an area within a single multi-purpose space	Yes	No

2. Number of machine shop theory and practice laboratory areas required (see Form E) _____

3. Student and teacher activities in various space divisions within the shop/laboratory area(s). Indicate the extent to which each activity will occur.

a. Machine tools space					
1) Machining parts	1	2	3	N	
2) Demonstrating operations	1	2	3	N	
3) _____	1	2	3	N	
b. Bench space					
1) Hand machining	1	2	3	N	
2) Demonstrating operations	1	2	3	N	
3) _____	1	2	3	N	
c. Inspection and layout space					
1) Quality assurance inspection	1	2	3	N	
2) Laying out castings and parts	1	2	3	N	
3) _____	1	2	3	N	
d. Assembly space					
1) Completing sub-assemblies	1	2	3	N	
2) Completing assemblies	1	2	3	N	
3) _____	1	2	3	N	
e. Welding and metal fabrication space					
1) Joining by gas welding	1	2	3	N	
2) Joining by arc welding	1	2	3	N	
3) Spot welding parts	1	2	3	N	
4) Fabricating steel sections	1	2	3	N	
5) _____	1	2	3	N	
f. Heat treating space					
1) Case hardening parts	1	2	3	N	
2) Hardening parts in heat treating furnace	1	2	3	N	
3) Quenching	1	2	3	N	
4) _____	1	2	3	N	
g. Demonstration space					
1) Other than a-2, b-2 above	1	2	3	N	
2) _____	1	2	3	N	

h. Planning space
   1) Planning procedures and operations — 1 2 3 N
   2) Research related to machining — 1 2 3 N
   3) _____ — 1 2 3 N
i. Office space
   1) Counseling students — 1 2 3 N
   2) Instructor's planning activities — 1 2 3 N
   3) _____ — 1 2 3 N
j. Tool room space
   1) Checking tools in and out — 1 2 3 N
   2) _____ — 1 2 3 N
k. Stock storage space
   1) Selecting and cutting-off stock — 1 2 3 N
   2) _____ — 1 2 3 N
l. Combustible storage space
   1) Storing materials of combustible nature — 1 2 3 N
   2) _____ — 1 2 3 N
m. Classroom space
   1) Conducting related subjects classes — 1 2 3 N
   2) _____ — 1 2 3 N
n. Other space(s) (specify) _____
   _____
   1) _____ — 1 2 3 N
   2) _____ — 1 2 3 N
   3) _____ — 1 2 3 N

4. Spatial relationships. Indicate the extent to which spaces should be accessible to each other.

a. Within the machine shop/laboratory area(s)
   1) Machine tools space to:
      a) Bench space — 1 2 3 N
      b) Inspection and layout space — 1 2 3 N
      c) Assembly space — 1 2 3 N
      d) Welding and metal fabrication space — 1 2 3 N
      e) Heat treating space — 1 2 3 N
      f) Demonstration space — 1 2 3 N
      g) Planning space — 1 2 3 N
      h) Office space — 1 2 3 N
      i) Tool room space — 1 2 3 N
      j) Stock storage space — 1 2 3 N
      k) Combustible storage space — 1 2 3 N
      l) Classroom space — 1 2 3 N
      m) Other (specify)
      _____ — 1 2 3 N
      _____ — 1 2 3 N
   2) Bench space to:
      a) Inspection and layout space — 1 2 3 N
      b) Assembly space — 1 2 3 N
      c) Welding and metal fabrication space — 1 2 3 N
      d) Heat treating space — 1 2 3 N
      e) Demonstration space — 1 2 3 N
      f) Planning space — 1 2 3 N
      g) Office space — 1 2 3 N
      h) Tool room space — 1 2 3 N

i)	Stock storage space	1	2	3	N
j)	Combustible storage space	1	2	3	N
k)	Classroom space	1	2	3	N
l)	Other (specify)				
	_____	1	2	3	N
	_____	1	2	3	N
3)	Inspection and layout space to:				
a)	Assembly space	1	2	3	N
b)	Welding and metal fabrication space	1	2	3	N
c)	Heat treating space	1	2	3	N
d)	Demonstration space	1	2	3	N
e)	Planning space	1	2	3	N
f)	Office space	1	2	3	N
g)	Tool room space	1	2	3	N
h)	Stock storage space	1	2	3	N
i)	Combustible storage space	1	2	3	N
j)	Classroom space	1	2	3	N
k)	Other (specify)				
	_____	1	2	3	N
	_____	1	2	3	N
4)	Assembly space to:				
a)	Welding and metal fabrication space	1	2	3	N
b)	Heat treating space	1	2	3	N
c)	Demonstration space	1	2	3	N
d)	Planning space	1	2	3	N
e)	Office space	1	2	3	N
f)	Tool room space	1	2	3	N
g)	Stock storage space	1	2	3	N
h)	Combustible storage space	1	2	3	N
i)	Classroom space	1	2	3	N
j)	Other (specify)				
	_____	1	2	3	N
	_____	1	2	3	N
5)	Welding and metal fabrication space to:				
a)	Heat treating space	1	2	3	N
b)	Demonstration space	1	2	3	N
c)	Planning space	1	2	3	N
d)	Office space	1	2	3	N
e)	Tool room space	1	2	3	N
f)	Stock storage space	1	2	3	N
g)	Combustible storage space	1	2	3	N
h)	Classroom space	1	2	3	N
i)	Other (specify)				
	_____	1	2	3	N
	_____	1	2	3	N
6)	Heat treating space to:				
a)	Demonstration space	1	2	3	N
b)	Planning space	1	2	3	N
c)	Office space	1	2	3	N
d)	Tool room space	1	2	3	N
e)	Stock storage space	1	2	3	N
f)	Combustible storage space	1	2	3	N
g)	Classroom space	1	2	3	N

h) Other (specify)					
_____	1	2	3	N	
_____	1	2	3	N	
7) Demonstration space to:					
a) Planning space	1	2	3	N	
b) Office space	1	2	3	N	
c) Tool room space	1	2	3	N	
d) Stock storage space	1	2	3	N	
e) Combustible storage space	1	2	3	N	
f) Classroom space	1	2	3	N	
g) Other (specify)					
_____	1	2	3	N	
_____	1	2	3	N	
8) Planning space to:					
a) Office space	1	2	3	N	
b) Tool room space	1	2	3	N	
c) Stock storage space	1	2	3	N	
d) Combustible storage space	1	2	3	N	
e) Classroom space	1	2	3	N	
f) Other (specify)					
_____	1	2	3	N	
_____	1	2	3	N	
9) Office space to:					
a) Tool room space	1	2	3	N	
b) Stock storage space	1	2	3	N	
c) Combustible storage space	1	2	3	N	
d) Classroom space	1	2	3	N	
e) Other (specify)					
_____	1	2	3	N	
_____	1	2	3	N	
10) Tool room space to:					
a) Stock storage space	1	2	3	N	
b) Combustible storage space	1	2	3	N	
c) Classroom space	1	2	3	N	
d) Other (specify)					
_____	1	2	3	N	
_____	1	2	3	N	
11) Stock storage space to:					
a) Combustible storage space	1	2	3	N	
b) Classroom space	1	2	3	N	
c) Other (specify)					
_____	1	2	3	N	
_____	1	2	3	N	
12) Combustible storage space to:					
a) Classroom space	1	2	3	N	
b) Other (specify)					
_____	1	2	3	N	
_____	1	2	3	N	
13) Classroom space to:					
a) Other (specify)					
_____	1	2	3	N	
_____	1	2	3	N	
b. Machine shop/laboratory area(s) to:					
1) Instructional materials center	1	2	3	N	
2) Building entrance	1	2	3	N	

3)	Delivery area	1	2	3	N
4)	Other instructional areas	1	2	3	N
5)	Other building areas (specify)				
	a) _____	1	2	3	N
	b) _____	1	2	3	N
	c) _____	1	2	3	N

5. Furniture and equipment

a.	Engine lathes Number of engine lathes required	P	A	NA
b.	Turret lathes Number of turret lathes required	P	A	NA
c.	Shapers Number of shapers required	P	A	NA
d.	Milling machines Number of milling machines required	P	A	NA
e.	Pedestal grinders Number of pedestal grinders required	P	A	NA
f.	Sensitive drill presses Number of sensitive drill presses required	P	A	NA
g.	Upright drill presses Number of upright drill presses required	P	A	NA
h.	Radial drill presses Number of radial drill presses required	P	A	NA
i.	Planers Number of planers required	P	A	NA
j.	Boring machines Number of boring machines required	P	A	NA
k.	Cut-off saws Number of cut-off saws required	P	A	NA
l.	Contour saws Number of contour saws required	P	A	NA
m.	Die filing machines Number of die filing machines required	P	A	NA
n.	Broaching machines Number of broaching machines required	P	A	NA
o.	Gear machines Number of gear machines required	P	A	NA
p.	Tracer lathes Number of tracer lathes required	P	A	NA
q.	Numerical control milling machines Number of numerical control milling machines required	P	A	NA
r.	Numerical control drill presses Number of numerical control drill presses required	P	A	NA
s.	Salt bath furnaces Number of salt bath furnaces required	P	A	NA
t.	Heat treating furnaces Number of heat treating furnaces required	P	A	NA
u.	Work benches Number of work benches required	P	A	NA
v.	Inspection tables	P	A	NA

	Number of inspection tables required	
w.	Planning tables	P A NA
	Number of planning tables required	
x.	Cylindrical grinders	P A NA
	Number of cylindrical grinders required	
y.	Internal grinders	P A NA
	Number of internal grinders required	
z.	Surface grinders	P A NA
	Number of surface grinders required	
aa.	Tool and cutter grinders	P A NA
	Number of tool and cutter grinders required	
bb.	Arbor presses	P A NA
	Number of arbor presses required	
cc.	Arc welders	P A NA
	Number of arc welders required	
dd.	Gas welders	P A NA
	Number of gas welders required	
ee.	Spot welders	P A NA
	Number of spot welders required	
ff.	Toilets and wash rooms	P A NA
	1) Separation according to sex	P A NA
	2) Number of water closets required	_____
	3) Number of sinks required	_____
	4) Other (specify) _____	
gg.	Teachers desk	P A NA
	1) Shop desk	P A NA
	2) Provision for storage	Yes No
hh.	Filing cabinets, letter size	P A NA
	Number required	
ii.	Magazine racks	P A NA
	Number required	_____
jj.	Provision for darkening area(s)	
	1) Opaque blinds	P A NA
	2) Flexible room partitions	P A NA
	a) Provision for storage	Yes No
kk.	Projection screen	
	1) Wall-mounted	P A NA
	2) Provision for storage	Yes No
ll.	Chairs for students	
	1) Folding type	P A NA
	a) Number required	
	b) Provision for storage	Yes No
	2) Straight-back type	P A NA
	a) Number required	
	b) Provision for storage	Yes No
mm.	Tables for students	
	1) Folding type	P A NA
	a) Number required	
	b) Provision for storage	Yes No
	2) Permanent type	P A NA
	a) Number required	
	b) Provision for storage	Yes No

nn. Shelving
- 1) Fixed, open shelving — P A NA
  - Lineal feet required _____
- 2) Movable, open shelving — P A NA
  - a) Lineal feet required _____
  - b) Provision for storage — Yes No
- 3) Fixed, closed shelving — P A NA
  - a) Lineal feet required _____
- 4) Movable, closed shelving — P A NA
  - a) Lineal feet required _____
  - b) Provision for storage — Yes No

oo. Student seating
- 1) Individual desks and chairs — P A NA
  - a) Number of desks required _____
  - b) Provision for storage — Yes No
- 2) Permanent type — P A NA
  - a) Number required _____
  - b) Provision for storage — Yes No
- 3) Desk and chair combination — P A NA
  - a) Number required _____
  - b) Provision for storage — Yes No
- 4) Tables and chairs — P A NA
  - a) Number required _____
  - b) Provision for storage — Yes No

pp. Built-in lockers for student storage — P A NA

qq. Drinking fountain — P A NA

rr. Other equipment required for shop/laboratory area(s) are:
1) _____
2) _____
3) _____
4) _____
5) _____
6) _____
7) _____
8) _____
9) _____
10) _____
11) _____
12) _____
13) _____
14) _____
15) _____
16) _____
17) _____
18) _____

6. Environmental factors

a. Aesthetic. Factors to be considered in the aestic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of shop/laboratory area(s).

_____
_____

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the shop/laboratory area(s).

_____
_____
_____
_____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the shop/laboratory area(s).

_____
_____
_____
_____

d. Safety. In planning school buildings, safety for students and teachers is of prime concern. Indicate any special safety considerations which have implications for the shop/laboratory area(s).

_____
_____
_____
_____

7. Vertical instructional surfaces

a. Chalkboard
   1) Wall-mounted — P A NA
      Number of lineal feet _____
   2) Portable — P A NA
      a) Number of lineal feet _____
      b) Provision for storage — Yes No
b. Tackboard — P A NA
      Number of lineal feet _____
c. Pegboard — P A NA
      Number of lineal feet _____

8. Special utility services required

a. Electricity
   1) Machine tools, welders, and furnaces
      a) 110 V 1 Phase — Yes No
      b) 220 V 3 Phase — Yes No
      c) 440 V 3 Phase — Yes No
   2) Other electrical specifications
      a) _____
      b) _____
      c) _____
      d) _____

3) Special lighting requirements (specify)
   a) _____
   b) _____
   c) _____
   d) _____

b. Gas Yes No
   1) If other than standard specifications indicate below: (Indicate units using)
      a) _____
      b) _____
      c) _____

c. Water Yes No
   1) If other than standard specifications indicate below: (Indicate units using)
      a) _____
      b) _____
      c) _____

d. Air Yes No
   1) If other than standard line pressure indicate below: (Indicate units using)
      a) _____
      b) _____
      c) _____

9. Minimal space requirements in square feet

   a. Floor area in square feet for entire shop/ laboratory area(s) _____
   b. If distinct space divisions are desired according to function, give minimum floor area requirements in square feet for each of the following areas if included in desired program.
      1) Machine tools space _____
      2) Bench space _____
      3) Inspection and layout space _____
      4) Assembly space _____
      5) Welding and metal fabrication space _____
      6) Heat treating space _____
      7) Demonstration space _____
      8) Planning space _____
      9) Office space _____
      10) Tool room space _____
      11) Stock storage space _____
      12) Combustible storage space _____
      13) Classroom space _____
      14) _____ _____
      15) _____ _____

10. Other important factors to be considered in the planning of the shop/laboratory area(s) are:

_____
_____
_____
_____

FORM I

DESCRIPTION OF BLUEPRINT READING AND SHOP DRAWING LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING

1. The blueprint reading and shop drawing area(s) should be planned:

a. As independent unit(s)	Yes	No
b. In combination with _____ shop/laboratory area(s) (specify)		
c. In combination with seminar area(s)	Yes	No
d. In combination with lecture/demonstration area(s)	Yes	No
e. As an area within a single multi-purpose area(s)	Yes	No

2. Number of blueprint reading and shop drawing laboratory areas required (see Form E) ____

3. Student and teacher activities in various space divisions within the blueprint reading and shop drawing area(s). Indicate the extent to which each activity will occur.

a. Blueprint reading space				
1) Studying symbols, specifications and blueprints	1	2	3	N
2) Discussing elements of blueprints	1	2	3	N
3) Solving problems involving blueprints	1	2	3	N
4) _____	1	2	3	N
5) _____	1	2	3	N
b. Freehand sketching space				
1) Sketching views of machine parts	1	2	3	N
2) Discussing sketches of machine parts	1	2	3	N
3) _____	1	2	3	N
4) _____	1	2	3	N
c. Shop drawing space				
1) Planning shop drawings of machine parts	1	2	3	N
2) Making orthographic projections	1	2	3	N
3) Making pictorial drawings	1	2	3	N
d. Blueprinting space				
1) Making blueprints of tracings	1	2	3	N
2) _____	1	2	3	N

4. Spatial relationships. Indicate the extent to which spaces should be accessible to each other.

a. Within the blueprint reading and shop drawing area(s):				
1) Blueprint reading space to:				
a) Freehand sketching	1	2	3	N
b) Shop drawing	1	2	3	N
c) Blueprinting	1	2	3	N
d) Classroom or related space	1	2	3	N
e) Storage space	1	2	3	N

2

2) Freehand sketching space to:
   a) Shop drawing — 1 2 3 N
   b) Blueprinting — 1 2 3 N
   c) Classroom or related space — 1 2 3 N
   d) Storage space — 1 2 3 N
3) Shop drawing space to:
   a) Blueprinting — 1 2 3 N
   b) Classroom or related space — 1 2 3 N
   c) Storage space — 1 2 3 N
4) Blueprinting space to:
   a) Classroom or related space — 1 2 3 N
   b) Storage space — 1 2 3 N
5) Classroom or related space to:
   a) Storage space — 1 2 3 N
   b) _____ — 1 2 3 N
   c) _____ — 1 2 3 N

b. Blueprint reading and shop drawing area(s) to:
   1) Instructional materials center — 1 2 3 N
   2) Building entrance — 1 2 3 N
   3) Delivery area — 1 2 3 N
   4) Other instructional areas
      a) _____ — 1 2 3 N
      b) _____ — 1 2 3 N
      c) _____ — 1 2 3 N
   5) Other building areas
      a) _____ — 1 2 3 N
      b) _____ — 1 2 3 N
      c) _____ — 1 2 3 N

5. Furniture and equipment

a. Drawing table(s) — Yes No
   1) Number required
   2) Tilting top — P A NA
   3) Elevation adjustment — P A NA
   4) Built-in storage — P A NA
   5) Further description

   _____
   _____

b. Stool(s) — Yes No
   1) Number required
   2) Back rest — P A NA
   3) Adjustable height — P A NA
   4) Further description

   _____
   _____

c. Drawing board(s) — Yes No
   1) Number required
   2) Size
   3) Storage required — Yes No
   4) Further description

   _____
   _____

d. Drafting machine(s) Yes No
   1) Number required
   2) Further description
   _____
   _____

e. Blueprint machine(s) Yes No
   1) Number required
   2) Further description
   _____
   _____

f. Blueprint paper container Yes No
   1) Number required
   2) Further description
   _____
   _____

g. Pantograph(s) Yes No
   1) Number required
   2) Further description
   _____
   _____

h. Drawing instrument set(s) Yes No
   1) Number required
   2) Further description
   _____
   _____

i. Erasing machine(s) Yes No
   1) Number required
   2) Further description
   _____
   _____

j. Lettering set(s) Yes No
   1) Number required
   2) Further description
   _____
   _____

k. Paper cutter(s) Yes No
   1) Number required
   2) Size required
   3) Further description
   _____
   _____

l. Work table(s) Yes No
   1) Number required
   2) Size required
   3) Further description
   _____
   _____

m. Bookcase(s) Yes No
   1) Number required
   2) Size required
   3) Further description
   _____
   _____

n. Storage cabinet(s) — Yes / No
   1) Number required _____
   2) Size required _____
   3) Further description
   _____
   _____

o. File cabinet — Yes / No
   1) Number required _____
   2) Size required _____
   3) Further description
   _____
   _____

p. Teachers desk
   1) Single-pedestal — P A NA
   2) Double-pedestal — P A NA
   3) Provision for storage — Yes No

q. Projection screen
   1) Wall-mounted — P A NA
   2) Provision for storage — Yes No

r. Drinking fountain
   1) Inside — P A NA
   2) Outside — P A NA

s. Washing facilities
   1) Cold water — P A NA
   2) Hot water — P A NA

t. Other equipment required for blueprint reading and shop drawing area(s) are:
   1) _____
   2) _____
   3) _____
   4) _____
   5) _____
   6) _____
   7) _____
   8) _____
   9) _____
   10) _____

6. Environmental factors

   a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light. style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the blueprint reading and shop drawing area(s). _____
   _____
   _____

   b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considertions important to the planning of the blueprint reading and shop drawing area(s). _____
   _____
   _____

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the blueprint reading and shop drawing area(s).

_____
_____
_____
_____

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound systems. Indicate any special consideration important to the blueprint reading and shop drawing area(s).

_____
_____
_____
_____

e. Safety. In planning school buildings, safety for students and teachers is of prime concern. Indicate any special safety considerations which have implications for the blueprint reading and shop drawing area(s).

_____
_____
_____
_____

7. Vertical instructional surfaces

a. Chalkboard
   1) Wall-mounted — P A NA
      Number of lineal feet _____
   2) Portable — P A NA
      a) Number of lineal feet _____
      b) Provision for storage — Yes No
b. Tackboard — P A NA
      Number of lineal feet _____
c. Pegboard — P A NA
      Number of lineal feet _____

8. Special utility services required

a. Electricity
   1) Equipment
      a) 110 V 1 Phase — Yes No
      b) 220 V 3 Phase — Yes No
      c) 440 V 3 Phase — Yes No
   2) Special lighting requirements (specify)
      a) _____
      b) _____
      c) _____
      d) _____

3) Other electrical specifications
   a) _____
   b) _____
   c) _____
   d) _____

b. Gas
   1) Required in area(s) Yes No
   2) If other than standard specifications, indicate and list units requiring
      a) _____
      b) _____
      c) _____
      d) _____

c. Water
   1) Drinking fountain(s) Yes No
   2) Sinks Yes No
   3) Other (specify) _____
      _____

9. Minimal space requirements in square feet

   a. Floor area in square feet for entire blueprint reading and shop drawing area(s)
      _____.

   b. If distinct space divisions are desired according to function, give minimum floor area requirements in square feet for each of the following areas if included in desired program.
      1) Blueprint reading area _____
      2) Freehand sketching area _____
      3) Shop drawing area _____
      4) Blueprinting area _____
      5) _____ _____
      6) _____ _____

10. Other important factors to be considered in the planning of the blueprint reading and shop drawing area(s) are:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

FORM J

ADDITIONAL PLANNING CONSIDERATIONS

Other important factors to be considered in the overall planning and design of instructional areas for the planned vocational machine tool operation, machine shop, and tool and die making program(s) are:

PART IV

ANNOTATED BIBLIOGRAPHY

GENERAL FACILITY PLANNING

American Association of School Administrators. Planning America's School Buildings. Washington, D. C.: The Association, 1960.

Contributors to this publication were teachers, supervisors, administrators, architects, engineers, school board members, and school plant planning specialists. In addition to background material on school house construction, the book deals with specific topics including school surveys, analysis and computation of space and facility needs, enrollment projections, building designs, site selection, finance, and building maintenance and operation. Many pictures and illustrations are found, along with sample forms and outlines, which can be used in the facility planning process. No special consideration is given to unique problems faced in the planning for vocational and technical education facilities.

Boles, Harold W. Step by Step to Better School Facilities. New York: Holt, Rinehart, and Winston, 1965.

A textbook on overall planning procedures for new and improved school facilities. The typical topics (school surveys, building planning, site selection and acquisition, architectural planning, contracting for construction, and the equipping and furnishing of buildings) are covered. The only mention of vocational schools is on page 270 where the author quotes from another source:

> Vocational training should be de-emphasized in the schools since this training often becomes obsolete before it can be used; also, special "trade" and "vocational" schools should be discontinued, unless the vocational curriculum is liberal in approach and broad in character. Such schools are often used as dumping grounds for students who are not wanted elsewhere and often more than custodial care is provided for them. When more is provided, the skills taught are frequently too partial in nature.

Conrad, M. J. Four Steps to New Schools. Columbus, Ohio: Educational Administration and Facilities Division of the Bureau of Educational Research and Service. The Ohio State University.

A book prepared for the inexperienced school planner. The author emphasizes that a school building is an educational tool and should be designed to do the job they are intended to do. The four steps discussed are: 1) district-wide building survey, 2) educational planning, 3) architectural planning and construction, and 4) moving in and settling down. A glossary of important terms used in plant planning is located in the back of the book.

Conrad, M. J.; Wohlers, E. E.; and Griggs, Norman. School Plant Planning: An Annotated Bibliography. Columbus, Ohio: The Administration and Facilities Unit, School of Education, The Ohio State University, 1968.

A compilation of references in the following categories: general references; periodicals; overview of school plant field, district wide building survey; educational planning; the architect and his work; moving in and settling down; and related topics.

Finchum, R. N. Extended Use of School Facilities. Washington, D. C.: U. S. Department of Health, Education, and Welfare, 1967.

This manual is intended to assist officials of school districts who are planning programs for maximum use of school properties and who must develop policies and regulations for efficient management of such programs. Various schedules of facility use are illustrated for nine different school systems.

Green, Alan C. Educational Facilities with New Media. Washington, D. C.: Department of Audiovisual Instruction, National Education Association, 1966.

This work is designed to meet the needs of three distinct groups interested in providing educational facilities. Report A: "A Guide for Policy Makers" is directed to boards, administrators, planning committees, and institutional planners. Report B: "A Guide for the Design of Professions" is designed for architects, planners, and design specialists and planning committees; and Report C: "A Technical Guide" is intended for design-architects, engineers, equipment and furniture suppliers, and media specialists.

National Council on School House Construction. NCSC Guide for Planning Plants. East Lansing, Michigan: The Council, 1964.

A basic reference on school plant planning and construction for use by superintendents, school board members, school plant planners, state department of education personnel, local school system officials, collegiate institutions, architects, lay advisory groups, and graduate students. Major topics covered are: planning and programming

educational plants; spaces and equipment for learning; non-instructional systems; space organization and economy and resources. Much attention is given to plant planning through a description of a survey technique used to determine and satisfy school plant needs for a community. Site selection, kinds of instructional spaces, sonic, termal, and visual environments, and best use of natural and plant resources are also treated.

North Carolina. Department of Public Instruction. A Digest of Educational Planning. Raleigh.

The contents of this book include a description of what educational planning is, when it is done, who does it, and how it is done. The three steps of planning are identified as 1) identification and analysis of educational and facility needs, 2) adapting and implementing plant improvement programs, and 3) completing and evaluating a process of the educational planning.

North Carolina. Department of Public Instruction. The Division of School Planning. School Design. Raleigh.

Basic principles of school design is the thrust of this publication. It focuses on the interrelationship of patterns of school activities, organization of activities on the site, design potentials for various sites, and the building design data necessary for communicating the school's needs to the architect.

School Planning Laboratory. Spectrum of Electronic Teaching Aids in Education. Stanford, California: Stanford University, 1965.

This publication seeks to suggest which learning functions can be served electronically to symbolize the nature and progressive complexity of each electronic system, and finally to estimate budgets which will provide for adequate systems in relation to engineering and warranty costs.

Strevell, Wallace H. and Burke, Arvid J. Administration of the School Building Program. New York: McGraw-Hill Book Company, Inc., 1959.

A comprehensive textbook on the administration of the school plant program. The book is organized into three major parts: Part I--"Policy Decisions" deals with school building needs studies and long-range planning; Part II--"Program Recommendations" deals with local study of plant needs, evaluation of existing plant, determination of additional plant needs, site selection and development, and the preparation of educational specifications. Part III--"Project Administration" is concerned with the financial aspects of a building program and with public relations. There is a brief mention of the objectives of vocational education as contrasted with the objectives of general education on page 12.

The Cost of a Schoolhouse. New York: Educational Facilities Laboratories, 1960.

This book deals with the cost of a schoolhouse and the process of planning and financing it. It provides median costs for various building elements, designates individual responsibilities in process of building, and discusses arrangement of space and environmental factors.

VOCATIONAL-TECHNICAL FACILITY PLANNING

American Vocational Association. Developing Educational Specifications for Vocational and Practical Arts Facilities. Washington, D. C.: The Association.

The purpose of this publication is to reduce the broad principles and processes of school plant planning to those most applicable to vocational and practical arts education. Effective techniques for developing educational specifications are suggested. The committee provides a sequential treatment of program and administrative considerations, desired space and educational program, special site arrangement features, special physical aspects of building, and the financial requirements for the project.

Calder, Clarence R. Modern Media for Vocational-Technical Education. Connecticut: State Department of Education, 1967.

A study of related literature on programmed instruction, instructional films, instructional television, and learning from various instructional media. It analyzes new instructional media approaches used at North Carolina's Fundamental Learning Laboratories System, and the integrated experience approach at Oakland Community College.

Chase, William W.; Browne, Johnny W.; and Russo, Michael. Basic Planning Guide for Vocational and Technical Education Facilities. Washington, D. C.: Department of Health, Education, and Welfare, U. S. Government Printing Office, 1965.

A general guide that describes important steps to be followed in the planning for and construction of vocational and technical education facilities. Important topics covered are: the impact of the Vocational Education Act of 1963; surveys of area educational needs; use of consultant services; basic planning considerations; educational specifications; general planning; and school construction cost and outlay. Sample floor plans and picture illustrations of vocational schools are included.

McKee, Robert L. and Ripley, Katherine J. The Documentation of Steps to Establish a Technical College and the Evaluation of PERT as a Planning Tool for Educators. Bailey's Crossroads, Virginia: Unpublished report, 1966.

An account of the procedures followed in the establishment of a technical college within a period of less than 90 days. The entire planning process and implementation is described along with the PERT technique which was applied. The author concluded the PERT (Program Evaluation and Review Technique) was effective in assisting the planners in reaching their objectives within a short period of time.

Stanford University. Trends in Facility Design-Vocational-Technical Continuing Information Program. Stanford, California: School of Education, 1966.

The pamphlet emphasizes the need for a total flexibility concept in school building. Consideration is given to the use of building components to provide flexibility in space, lighting, air-conditioning, sewage system, and the like.

U. S. Department of Health, Education, and Welfare. New Ideas and Construction for Vocational Education. Washington, D. C.: Unpublished, 1967.

A report on new trends in the construction of vocational education facilities. Among topics covered are occupational clusters, teaching techniques such as micro-teaching and educational television, facilities for handicapped children, educational parks, and unique problems faced by large city school systems. Special consideration is given to maximum utilization of vocational education facilities on an around-the-clock basis.

Valentine, Ivan E. and Conrad, M. J. Progress Report: Vocational-Technical Facilities Project. Columbus, Ohio: The Center for Vocational and Technical Education, The Ohio State University, 1967.

A report which relates the thinking of six outstanding consultants on various topics relating current trends in vocational-technical education and facility planning. Reviews the work of a local consortium consisting of three Center vocational specialists, three school plant planners, three representatives from the State Department of Education, three local school officials, and three practicing architects in defining problems, clarifying issues, suggesting approaches to organizing planning guides, and establishing guidelines for a series of facility planning guides in selected vocational and technical subject areas.

Wohlers, A. E. A Manual for Planning A Secondary School Building (Vocational Education). Columbus, Ohio: The Administration and Facilities Unit, School of Education, The Ohio State University, Pamphlet C-14.

A general facility planning guide for programs of vocational education. Principal topics covered include: 1) number of teaching stations, 2) types of teaching stations, 3) equipment needs, and 4) floor areas required. The planning manual also

deals with spatial relationships of teaching facilities and the utilization of auxiliary areas such as libraries, cafeterias, and administrative suites. Planners using the guide are directed to complete checklists and fill-in blanks with the necessary information pertinent to vocational facility planning.

METAL TRADES FACILITY PLANNING

Michigan. Department of Public Instruction. Industrial Education Facilities. Bulletin No. 2135. Lansing: 1964.

This publication consists of three sections: 1) pre-planning for school shops and facilities, 2) industrial arts laboratories, 3) shop architecture. Part II under the section, "general metals," includes twelve considerations in planning a metals shop. Several of these suggestions have application for machine shop planning.

Modern School Shop Planning. Ann Arbor, Michigan: Prakken Publications, Inc., 1965.

An excellent volume of material on planning and equipping the school shop. This book describes planning the machine shop in Section VII. Covered under this section are such items as: planning the machine shop, new machine shops, equipping the machine shop, space requirements in the machine shop, and storage problems in the school machine shop. In addition to the treatment for machine shop, this volume also contains sections devoted to such topics as: general shop, automotive, drafting, electricity and electronics, graphic arts, metalworking, woodworking, technician training, purchasing and equipping considerations, and equipment and material suppliers.

National Council on Schoolhouse Construction. Secondary School Plant Planning. East Lansing, Michigan: 1957

This publication contains a section devoted to instructional space which includes shop planning. Covered are such items as: general requirements for shop facilities, vocational trades and industries shops, and industrial arts shops. Other chapters treat such topics as: the planning process, new approaches in secondary education, the general nature of the high school plant, general and service facilities, and the balanced conditioning of spaces for education.

U. S. Department of Health, Education, and Welfare. Mechanical Technology Design and Production (OE-80019). Washington, D. C.: Superintendent of Documents, 1964.

This publication devotes space to instructional facility suggestions, and equipment and supplies. Covered under this section are lists of equipment for drafting laboratory, and also for metals laboratory. Contained in the publication is

information relative to curricula and course outlines for the various courses of two options of mechanical technology: 1) design option and 2) production option.

Weaver, Gilbert G. Shop Organization and Management. New York, New York: Pitman Publishing Corporation, 1955.

Included in this book are three chapters significant for planners of the machine trades, namely: 1) planning the school shop, 2) making the shop layout, and 3) selection and purchase of machines, tools, equipment and materials. In addition, this book provides information relative to such other subjects as: school construction for vocational and industrial arts education, comparison of a school shop with a commercial shop, storage and control of handtools and materials, and physical conditions in the shop.

Wisconsin. Guidelines for Realistic Facility Planning for Schools of Vocational, Technical and Adult Education. Madison, Wisconsin: The State Board of Vocational, Technical and Adult Education, 1964.

Included in this publication are suggested guideline standards for trade and industrial education as well as for the other main services of vocational and technical education. The guideline deals with class sizes and space requirements for each of the services, and the principle divisions of the services. Other items covered in the publication are: procedure for planning facilities, planning a vocational education facility, a check list for facility planning, and related topics.

PUBLICATIONS OF
THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION

RESEARCH SERIES

no.	name of publication	cost
1	A National Survey of Vocational Education Programs for Students with Special Needs. April 1967. 89+ [14] p. ED011041	$2.00
2	The Demand for and Selected Sources of Teachers in Vocational and Technical Education, State Directory. January 1967. 31+[51] p. ED012331	o
3	Research and Development Priorities in Technical Education. May 1967. 34 p. ED013888	o
4	Review and Synthesis of Research in Agricultural Education. August 1966. 140 p. ED011562	1.50
5	Review and Synthesis of Research in Business and Office Occupations Education. August 1966. 128 p. ED011566	o
6	Review and Synthesis of Research in Distributive Education. August 1966. 212 p. ED011565	o
7	Review and Synthesis of Research in Home Economics Education. August 1966. 104 p. ED011563	o
8	Review and Synthesis of Research in Industrial Arts Education. August 1966. 88 p. ED011564	o
9	Review and Synthesis of Research in Technical Education. August 1966. 69 p. ED011559	1.50
10	Review and Synthesis of Research in Trade and Industrial Education. August 1966. 76 p. ED011560	o
	Set of Seven Research Reviews (nos. 4-10)	10.00
11	The Emerging Role of State Education Departments with Specific Implications for Divisions of Vocational-Technical Education. 1967. ED016870	4.50
12	A Taxonomy of Office Activities for Business and Office Education. July 1968. 163 p. VT005935 RIE	2.75
13	Enlisted Men Separating from the Military Service as a Potential Source of Teachers for Vocational and Technical Schools. October 1967. 53 p. ED016131	*
14	Boost: Business and Office Education Student Training; Preliminary Report. 1967. 251 p. VT005131 RIE	3.00
18	Research Priorities in Technical Teacher Education: A Planning Model. October 1967. 48 p. ED016815	o
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1	Report of a National Seminar on Agricultural Education, "Program Development and Research," August 9-13, 1965. 176 p. ED011036	*
2	Guidance in Vocational Education. Guidelines for Research and Practice. 1966. 181 p. ED011922	o
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4	National Vocational-Technical Education Seminar on the Development and Coordination of Research by State Research Coordinating Units. 1966. 72 p. ED011042	o
5	A Report of the Business and Office Education Research Planning Conference. 1966. 116 p. ED013304	o
6	Program Development for Occupational Education. A Report of a National Seminar for Leaders in Home Economics Education, March 28-31, 1966. 118 p. ED011040	o
7	Report of a National Invitational Research Planning Conference on Trade and Industrial Teacher Education, May 23-27, 1966. 1966. 197 p. ED011043	2.00

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8	Report of a National Seminar, "Evaluation and Program Planning in Agricultural Education," June 27-30, 1966. 1966. 129 p. ED011037	o
9	Health Occupations Education Centers: Report of a National Seminar held July 11-14, 1966. 1967. ED016823	o
10	Guidelines for Cooperative Education and Selected Materials from the National Seminar held August 1-5, 1966. 1967. 255 p. ED011044	o
11	Systems Under Development for Vocational Guidance. 1966. 60 p. ED011039	o
12	Compilation of Technical Education Instructional Materials--Supplement I. April 1967. 203 p. ED012340	3.00
13	Compilation of Technical Education Instructional Materials--Supplement II. April 1967. 242 p. ED011933	3.50
14	Educational Media in Vocational and Technical Education: Report of a National Seminar. 1967. 240 p. ED017730	o
15	Vocational-Technical Education: National Seminar Proceedings. 1968. 283 p. VT005627 RIE	3.25
16	National Program Development Institutes in Technical Education, Summer 1967: A Compilation of Selected Presentations and Instructional Materials. 194 p. VT005628 RIE	o

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2	Worker Adjustment: Youth in Transition from School to Work: An Annotated Bibliography. 1968. 135 p. VT005631 RIE	3.25

INFORMATION SERIES

Abstracts of Research and Related Materials in Vocational and Technical Education. Fall 1967. Quarterly.	9.00 per year
Abstracts of Instructional Materials in Vocational and Technical Education. Fall 1967. Quarterly.	9.00 per year
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